IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	Lescoche Philippe	Examiner:	Mellon David C.
Serial No.:	10/532,560	Group Art Unit:	1797
Filed:	April 25, 2005	Docket No.:	
Title:	Membrane for tangential filtration and production method thereof		

DECLARATION OF GRANGEON André PURSUANT TO 37 C.F.R § 1.132

I, the undersigned, GRANGEON André, of French nationality, doctor of university of LYON I (France) in the speciality of catalyse, past chairman of the board of TAMI Industries, with an experience of 25 years in the field of ceramic membranes, inventor or co-inventor of 15 patents in this field.

I am familiar with the English language and I am familiar with the patent application identified above, and with the prior art Childs et al. (US 7,247,370), Garcera et al. (US 6,375,014), Grangeon et al. (US 6,499,606) and Pirbazari et al. (US 5,505,841) discussed in the prosecution of the above-mentioned patent application. I am specifically aware of the contents of the outstanding Office Action in this case, dated May 6, 2009.

The patent application US 10/532,560 discloses and claims a membrane for tangential filtration of a fluid including one or several flow channels for the fluid to be treated flowing in a given direction between an inlet and an outlet. As indicated on page 1, lines 13 to 16, on page 6 lines 13 to 19 and in claim 1, the filtration of the fluid is achieved by a separation layer deposited on the surface of each channel of the support. The invention consists in the use of a partial pore-filing obtained with inorganic particles which consists in a pressure brake, in order to obtain an homogeneous permeate flow.

Indeed, as specified on page 4, lines 3 to 9, the invention proposes a tangential filtration membrane adapted to obtain an homogeneous permeate flow along the length of the membrane "and which does not have any weak area in which species of the fluid to be treated may build up and be retained by the membrane. The solution put forward by the invention consists of modifying the porous support on its part adjacent to the separator layer to cause it to participate in membrane permeability." This modification consists in a partial pore-filing that extends from each inner surface of support on which the separator layer is deposited, this said partial pore-filling, on a portion of support of a given constant thickness extending from the inner surface of support, creating a mean porosity gradient in the direction of flow of the fluid to be treated, the minimum mean porosity being located at the inlet and the maximum mean porosity at the outlet.

In the outstanding Office Action, the Examiner maintained his objection that the subject-matter of claims 1-4 and 6-9 are unpatentable over Garcera et al. in view of Childs et al. and further in view of Grangeon et al. or Pirbazari et al. according to 35 U.S.C. § 103.

As stated in the patent application page 2 lines 20 to 26, in traditional membrane for tangential filtration, "since the acting filtering force is pressure, there is a decreasing variation in the pressure of the fluid to be treated over the length of the channels. Said pressure gradient modifies the cross flow of the permeate which passes through the separator layer and then the porous body. The flow rate of the permeate therefore varies along the length of the membrane. This flow rate gradient of the permeate leads to heterogeneous separation by the membrane giving rise to different separation schedules along the channels."

Garcera et al. tries to solve this problem and proposes to modify the external porosity of a macroporous support in order to provide a porosity gradient along the length of this support. This porosity gradient gives rise to a permeability gradient. On account of the variation in pressure, the flow rate of the permeate passing through the membrane becomes constant. This porosity gradient located at a belt region starting from the outer surface of the support as shown on Figure 1 of Garcera et al, does not participate to the filtration of the fluid, which is already treated at each

channel, by a filtration layer. The solution proposed by Garcera et al. intended to improve the previous solutions compensating head loss, either by ensuring tangential flow of the permeate on the outside of the membrane, in the same direction as the fluid to be treated flowing tangentially inside the channels (US 4,105,547) or by arranging beads in the permeate compartment to obtain identical head losses to those of the liquid to be treated with a very low flow rate (EP 0333753). Garcera et al. acts, as the previous proposed solutions, on the permeate and not on the fluid to be treated.

In Garcera et al. the membrane includes a filtering layer covering the surface of the channels, as mentioned column 1 lines 7 to 14 and 17 to 23, column 2 lines 56-58, column 4 lines 3-6, column 5 lines 1 to 8, lines 28 to 33 and lines 46-52, and in examples 2, 3 and 5. The filtering layers provides the filtration of the fluid. The impregnated region does not participate to filtration, as a result of its localization at the periphery of the support. As mentioned in column 5 lines 46 to 52, "the porosity of the modified region together with the decrease thereof in the longitudinal direction of flow of the fluid to be treated results in good homogeneity of transmembrane pressure between the inside of the channels and the interface between the filtering layer and the macroporous support along the channel(s), and thus homogeneity of the permeation flow."

Childs et al. concerns a very specific kind of membrane that is very different from those disclosed by Garcera et al. As stressed by Childs et al. column 2 lines 4 to 14 "In pore-filled membranes a low density, cross-linked gel is contained within the pores of a microporous substrate and serves as the separating "layer". Because of the nature of the gel it has to be prevented from excessive swelling in contact with water or other gel-swelling solvents by the physical constraint imposed upon it by the microporous host. As a result, in pore-filed membranes attempts are made to avoid having gel surface layers but instead to ensure that the gel is held within the pores of the host. " There is a fundamental difference in membrane construction between pore-filled membranes as described by Childs et al. and membranes which used a separation layer deposited on the support to achieve the filtration function as described by Garcera et al.

In Childs et al. a crosslinked gel such as a hydrogel or a polyelectrolyte hydrogel described from column 4 to column 9 is included inside the support and provide the filtration. Childs describes an planar membrane in which, "the density of the crosslinked gel is substantially greater at or adjacent to one major surface or the membrane than the density at or adjacent to the other major surface of the membrane." (column 4 lines 3 to 7)

The use of such a gel in such a configuration provides membranes with high flux at low pressure (column 4 lines 47-49 and column 10 lines 36-37 and 39-40). As stated column 10 lines 36-41, as shown in the exemples, the membrane proposed by Childs et al. with " about 5 times higher than that of a high quality commercially available nanofiltration membrane."

The impregnation with a gel used in Childs et al cannot be compared to the impregnation used in Garcera et al. There is at least 3 fundamental differences :

- their function is different : in Garcera et al. the impregnation with a mineral suspension is used to provide by the mean of the mineral particles, a pressure brake. In Childs et al. the impregnation is used as an integrated filtration layer,
- their nature is different the gel used by Childs et al. are porous in itself. The gel increase the flux whereas in Garcera et al. the material used for impregnation is not porous and provides a partial clogging of the support in order to brake pressure. Even the organic material (epoxy resin, polymer such as PTFE) cited column 6 lines 8-11 of Gracera et al. cannot be compared with the hydrogel or polyelectrolyte hydrogel used by Childs et al.
- their localization is different : in Garcera et al. the impregnation is at the periphery of the multi-channel support and there is a porosity gradient in the direction of flow of the fluid to be treated whereas in Childs et al. the density of gel impregnation is greater or adjacent to one major surface of the planar membrane.

For all the above-mentioned reasons the skilled man would be quite certain that the teaching of Childs et al. has no interest for the achievement of an homogeneous permeate flow along the length of the membrane. And, as a result, it is not possible to say that "It would have been obvious to one of ordinary skill in the art at the time

of the invention to modify the partial-pore filled membrane structure of Garcera et al. by making it such that the partial-pore filling occurs from the inside of the membrane to the outside as taught by Childs et al. for the purpose of decreasing the amount of fouling experienced by the membrane during operation." as mentioned in the Office Action dated May 6, 2009.

Furthermore, since Childs et al. clearly teaches the use of a pore filled region of the support with a cross linked gel as filtration layer, even if a man skilled in the art would like to use this teaching on Garcera et al. he would simply change the separation mean and replace the separation layer deposited on the support used in Garcera by the pore filled region taught by Childs et al. This pore filled region with a cross-linked gel has to be very specific in order to achieve its separation function and is fundamentally different from the partial clogging with inorganic particulates proposed by the claimed invention which acts as a pressure brake. Moreover, none of the discussed documents, even Grangeon et al. and Pirbazari et al., suggest to include a pre-filter component to the membrane in order to improve the separation.

The pore-filled impregnation with a cross-linked gel used in Childs et al. and the separation layer deposited on the support in Grangeon et al. and Pirbazari et al. are very different configuration to achieve filtration. These two configurations are not suplementary and cannot be combined.

I hereby declare that all statements made herein of my own knowledge are true, and that all statements made on information and belief are believed to be true; and further that these statements are made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Date: 1st November 2009

By: André GRANGEON